

**MARINE PRODUCT
TANKER FUNDAMENTALS,
ECONOMICS & OUTLOOK**

CONSULTANT REPORT

MARCH 2002
P600-02-007CR



Gray Davis, Governor

CALIFORNIA ENERGY COMMISSION

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Task 3: Marine Product Tanker Fundamentals, Economics & Outlook

Prepared for:

The CALIFORNIA ENERGY COMMISSION

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March, 2002**

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Purpose

The purpose of this work is to support California Energy Commission (CEC) staff in research mandated by AB 2098. This legislation directs the CEC to examine the feasibility of financing, constructing and maintaining a new pipeline or utilizing or expanding the capacity of existing pipelines to transport motor vehicle fuel or its components from the U.S. Gulf Coast (USGC) to California. This pipeline analysis has been broken into the following five tasks:

- Task 1. Petroleum product pipeline fundamentals and economics.
- Task 2. Supply potential for petroleum products in the USGC.
- Task 3. Marine product tanker fundamentals, economics and outlook.
- Task 4. Petroleum product pipeline system modifications, costs, benefits, and funding mechanisms.
- Task 5. Cost/benefit summary and additional areas of concern.

This report is concerned with Task 3.

Introduction

In order to determine the economic feasibility of a pipeline from the USGC to California, the economics and availability of the marine tanker fleet to deliver refined products to California must first be determined. Banning MTBE from California gasoline in 2003 may create a need to import as much as an additional 100,000 barrels per day of finished product and/or blending components into California. This report examines:

- Historical product tanker cargo movements
- Domestic product tanker outlook
- Product tanker demand
- Product tanker economics
- Other issues

The report concludes that US flagged tanker availability to move USGC products to California is tight in the near-term and will be inadequate after 2005.

Overview

- Jones Act requires products from one US port to another US destination be shipped on a domestic flag vessel.
- Current Jones Act fleet is committed to moving products for which no alternate marine transportation is readily available.
- Jones Act tankers will gradually be forced to retire under the Oil Pollution Act of 1990 (OPA90).

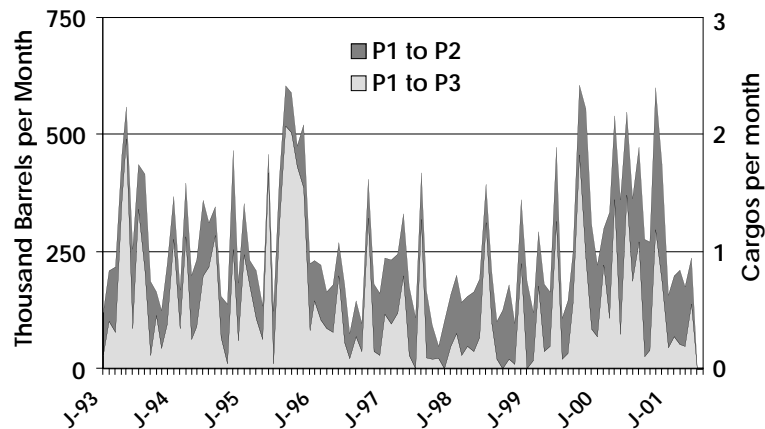
The combination of factors listed above will create a situation in which adequate Jones Act tankers may not be available to move product from the US Gulf Coast to California in 2003 & 2004. Further, an increasing shortfall of product tankers is anticipated after the forced OPA90 retirements begin in 2005.

Historical Product Tanker Cargo Movements

The following charts summarize waterborne hydrocarbon movements between various Petroleum Administration Defense Districts (PADDs). Each PADD consists of a group of states that are contiguous to one another and associated with a specific geographic region of the United States, such as the East Coast, West Coast, etc.

Figure 1

Total PADD 1 to Other US via Water

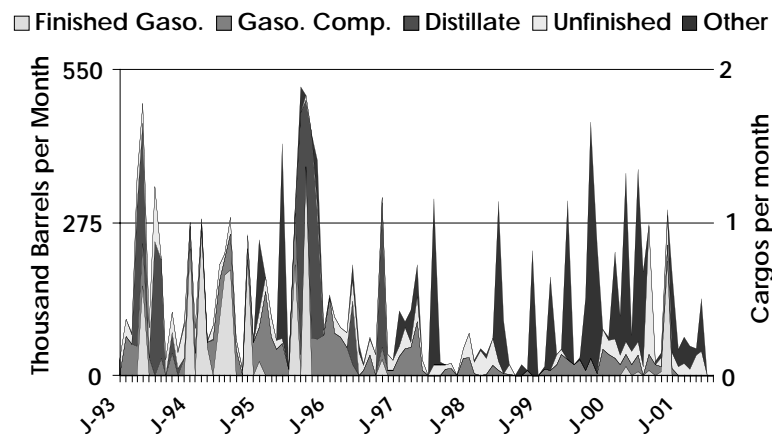


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Figure 2

PADD 1 to PADD 3 via Water (Not many backhauls available)

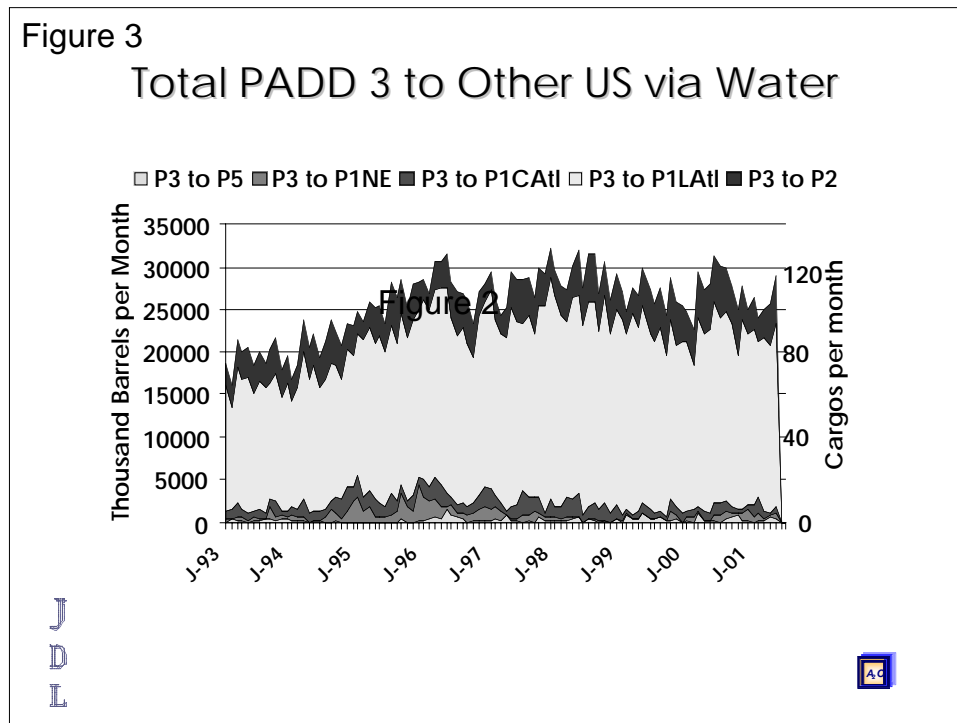


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Figures 1 & 2 show that it takes about 1 to 2 cargoes per month to meet the PADD 1 (East Coast) to PADD 3 (USGC) needs. The primary reason for these shipments is the need to move vacuum gas oil (VGO) and naphtha from the East Coast to the Gulf Coast. The gasoline back-haul from PADD 3 to PADD 1 is secondary. Typically blendstocks and feedstocks move from the East Coast to the Gulf Coast because historically the East Coast has consumed more fuel oil and their refinery modernization has not kept pace with changing demand. It takes two to three days to prepare a clean ship by eliminating the vapors from the vessel before it can load VGO and move it to the Gulf Coast.

Once in the Gulf Coast, these ships have to be cleaned so the shipment does not affect gasoline or diesel quality being moved to the East Coast. The time spent on cleaning each vessel in preparation for their next cargo slows movement of product from the Gulf Coast to the East Coast. Typically ships in this service can only move two loads per month instead of the potential three loads per month.



As shown in Figures 3 and 4, the greatest volume of petroleum product moves from the USGC to the Lower Atlantic States. This is due to lack of local refining capacity and product pipelines in that part of PADD 3. **Product tankers must continue in this service.** The Lower Atlantic States (Georgia and Florida) are supplied primarily by water from PADD 3 while the Central Atlantic and New England States have pipeline service from the US Gulf Coast. There is no petroleum product pipeline connecting Florida to refinery supply centers (such as the USGC). The difference in the number of cargoes going to PADD 1 from PADD 3 and those going to PADD 3 from PADD 1 indicates that there are few back-hauls available.

U.S. product demand for Florida and the Southeastern (Lower Atlantic) states is met primarily by waterborne deliveries. The terminals in the Southeast are not well equipped to handle full cargo lots of a single finished product. U.S. vessels typically drop off product to multiple terminals or haul multiple grades of products to a single terminal. The lack of U.S. quality clean fuels from foreign sources and the larger cargo sizes of foreign vessels diminishes the likelihood that product that is currently shipped to Florida from the USGC can be replaced with foreign products on a continuous basis. The upcoming desulfurization of US gasoline and diesel products will make the alternate supply situation worse if USGC refinery capacity declines as anticipated. Therefore, most clean products must continue to be shipped by

domestic vessels from the U.S. Gulf Coast to Florida, which greatly diminished the probability that an adequate number of product tankers can be reassigned to deliver gasoline and blending components to California from the USGC

Figure 4

PADD 3 to PADD 1 via Water

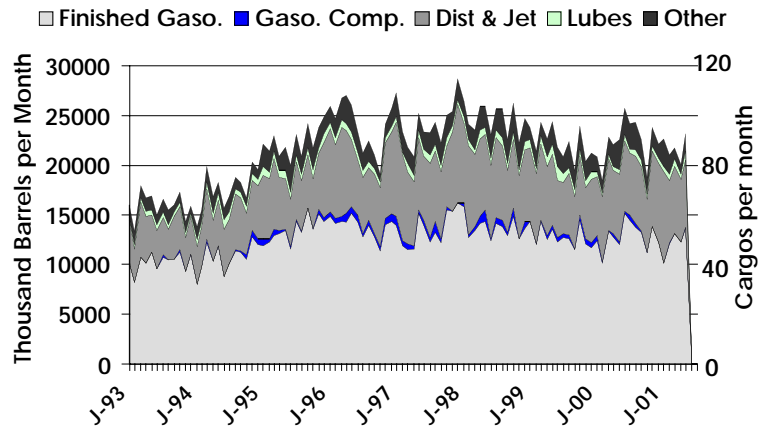
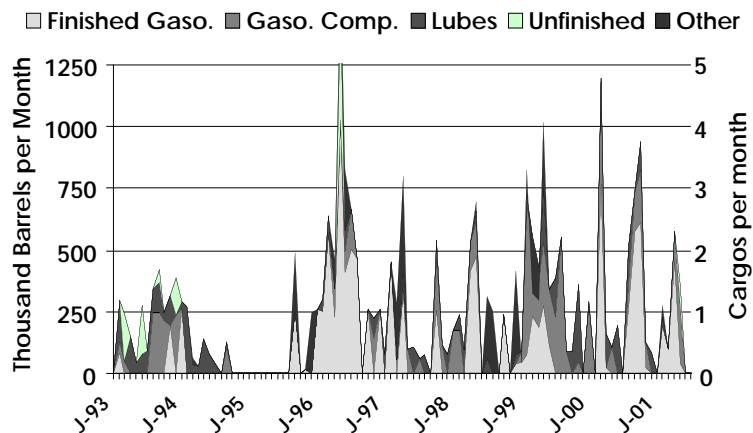


Figure 5 shows the PADD 3 (USGC) to PADD 5 (West Coast) product movement via water shipments.

Figure 5

PADD 3 to PADD 5 via Water



The number of cargoes seem relatively small (compared to Figure 4) but each PADD 3 to PADD 5 trip is equivalent to four PADD 3 to PADD 1 trips as far as tanker demand is concerned. An example of the impact created by shifting a product tanker from service between the USGC and Florida to service between the USGC and California is illustrated below.

A vessel moving to Jacksonville from Houston will typically require 11 days to complete a round-trip between these two ports. A breakdown of the time is summarized in Table 1.

Table 1: Roundtrip Time Houston to Florida

Activity	Time (Days)
Load	1.5
Transit	4
Discharge	1.5
Return to Houston	4
Total	11

If a typical West Coast voyage is 44 days, this same vessel could have supplied 4 voyages at approximately 275,000 bbls/vessel, or 1,100,000 barrels to Jacksonville in the same period of time. In other words, *each* vessel removed from USGC to Jacksonville service would have to be replaced with 33 foreign cargoes per year of equivalent volume. Foreign imports to Florida would need to be increased substantially to displace barrels currently delivered from the Gulf Coast by product tanker. It is more likely that foreign imports to the Northeast US (New York Harbor) would increase to displace product tanker movements between the USGC and the Northeast.

Unfortunately, the type of gasoline shipped to Florida and the Northeast from the USGC is not suitable for sale in California. This means that USGC refiners would be unwilling to cease these product tanker shipments unless they had alternative markets they could serve via product pipeline. If these alternative market opportunities do not develop, it is extremely doubtful that 16 product tankers could be diverted to ship gasoline and components to California.

Domestic Product Tanker Outlook

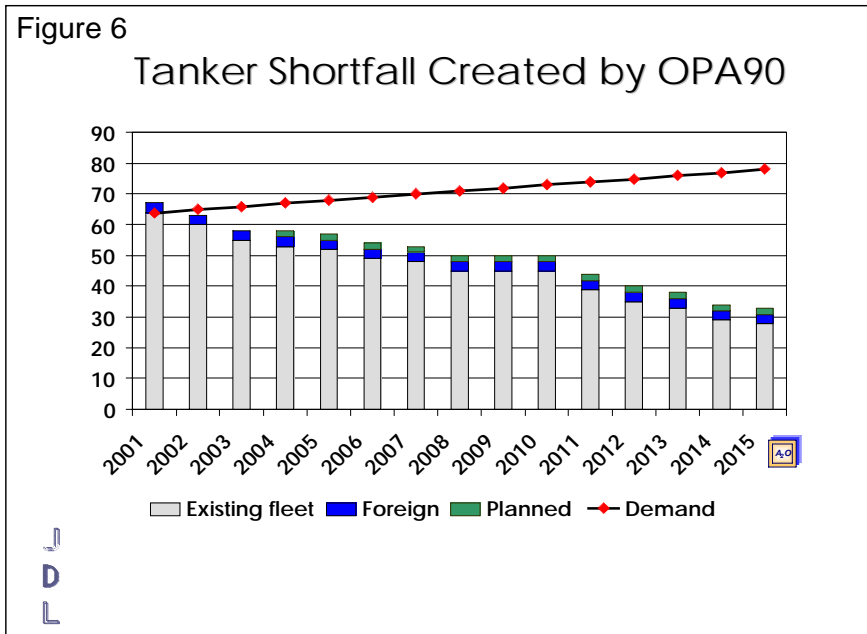
Figure 6 shows that the current clean US flag product tanker fleet contains 64 vessels. Three foreign built vessels are also in the fleet. Only two new product ships are planned for construction through 2004. These ships are not planned to be routinely in California or Gulf Coast Service. Most likely, they will serve the West Coast and Northwest market. Current and planned construction is lagging behind the projected need of 2 additional vessels per year even before we consider the forced tanker retirements under the Oil Pollution Act of 1990 (OPA90).

Declining Product Tanker Fleet

OPA90 requires phase-out of 36 product tankers between 2001 and 2015. Thirteen vessels are OPA90 exempt due to the double hull construction. Records indicate that all single hull vessels will be phased out over the next 15 or so years. Fifteen product tankers will be phased out by 2006. Ten additional vessels will be retired in 2011. Another eleven vessels will be retired by 2015. Figure 6 illustrates the tanker shortfall created by OPA90.

Jones Act crude oil tankers are also declining from the domestic fleet at a faster rate than the product tankers. This situation will impact the ability of the US shipbuilding industry to quickly respond to new ship orders that are expected to emerge over the near-term. There are only three shipyards capable of building U.S. flag tankers. They are: Nasco in San Diego; Avondale in New Orleans and another yard

located in Philadelphia. These yards are essentially idle for this type of business at this time. Construction time is usually 2 to 3 years. If orders for both domestic product tankers and crude tankers begin to accumulate over a short period of time, these shipyards may not be able to keep pace with the orders. In other words, the time required to construct new Jones Act product tanker could be extended, if and when additional orders are placed.



Product Tanker Demand

Demand for U.S. Flagged Ships

The U.S. markets in Florida and the Southeast must currently be served by vessels due to the lack of a clean product pipelines. Ships also fill the void when inland U.S. barge availability becomes tight. A recent example is that barges were required to move products to Chicago due to pipeline shipments being full. Gulf Coast barges were moved up from the Gulf Coast to Chicago leaving vessel movements to go from Corpus Christie to Houston, Houston to New Orleans, and then back from New Orleans to Corpus Christie. American flagships that were available simply filled the demand for products transiting between Gulf Coast ports.

There is also a seasonal demand increase for Jones Act product tankers during the winter months to transport heating oil from the USGC to New York Harbor. Unusual cold snaps can result in temporary price spikes for heating oil in the Northwest. It is possible for refiners and other market participants to respond to these price spikes using product tankers because a ship can move product faster from the Gulf Coast to the New York Harbor than pipeline movements. Therefore, during unusually cold winters, these demand swings can dramatically affect U.S. product tanker availability.

The Jones Act also serves to ensure that vessels are available to satisfy military demand. World events can sometimes lead to increased military activity that necessitates the use of Jones Act product tankers for temporary service. This is another example of a circumstance that can reduce the availability of Jones Act vessels for non-military purposes.

US Vessel Availability for California

A small number of U.S. flagged ships are available to transport clean product to California on a sustained basis. Most U.S. flagged ships are utilized on specific routes. For example, while the cargoes are few, vacuum gas oil (VGO) and naphtha must move from the East Coast to the Gulf Coast. Even though the cleaning process that occurs on both ends of the voyage takes time and limits the ships to 2 trips per month instead of 3, ships are the only viable means to transport this product. Florida and the other U.S. Southeast markets (Lower Atlantic) must be served by vessel because there is no product pipeline. The markets that are currently being served can not easily adapt to the loss of U.S. flagged vessels that supply their product needs. It would be difficult to replace the product supplied by US flagged vessels into these markets.

Voyage Time from the US Gulf Coast to California

Let us consider the logistics of a voyage from the USGC to California via the Panama Canal. To move product from the USGC to California on a tanker, an operator must: accumulate the cargo, load the vessel, sail to Panama, wait for a slot in the canal, traverse the canal, sail to either Los Angeles or San Francisco and unload the cargo. After the cargo is accumulated, a typical trip to Los Angeles takes 20.5 days while a trip to San Francisco requires 22.5 days. Because the vessel must return to the USGC for the next cargo, the typical round-trip time requires a total of 41 to 45 days. A more detailed breakdown of a typical trip is shown in Table 2.

Table 2: Vessel Trip Time to California

Activity	Time (hours)
Berthing	5
Loading (275 mbbls @ 8 mbbl/hr)	35
Deberthing	5
In transit: USGC to Panama	120
Typical average wait time for canal transition	48
(Due to maintenance, wait time can be as long as:)	96-192
Canal traverse time	8
In transit: Panama Canal to Los Angeles	216
In transit: Panama Canal to San Francisco	264
Time waiting for berth	12
Berthing	5
Discharging (275 mbbls @ 8 mbbl/hr)	35
Completion of paperwork	5
Total voyage time	Days
USGC to Los Angeles	20.5
USGC to San Francisco	22.5

California Product Tanker Requirements

The worst case scenario involves no foreign supply. Following the phaseout of MTBE, California may be short by as much as 100,000 barrels per day of gasoline. The average total voyage time for a vessel is approximately 44 days to San Francisco. In addition, the average volume a vessel can carry is 275,000 barrels. Therefore, the average vessel can bring 6,250 barrels per day of the shortfall (275,000/44). A shortfall of 100,000 barrels per day would thus require 16 ships (100,000/6,250) to be constantly moving between the coasts. If there is no wait at the Panama Canal, the number of ships required would be reduced to 14.

But no wait time at the Panama Canal would be an unusual circumstance. The average wait time over the last several years has been two days. Because each roundtrip to California from the Gulf Coast is equivalent to 4 USGC to Southeastern states roundtrips, 64 cargoes would have to find an alternate route to the lower Atlantic states. This is not possible!

Further, if the volume of additional imports from the USGC were assumed to be at the lower end of the supply shortfall estimate (56,000 barrels per day), the number of ships required would decline to 8 or 9.

The best case scenario assumes that foreign flagged vessels can deliver California grade gasoline and blendstocks. The vessels are available. Some quality supply can be found in Canada, the Caribbean and Europe. But, those sources of supply are limited. If they are diverted to make California gasoline, US RFG imports to the East Coast could be severely impacted. The production of one California gasoline cargo would divert clean blendstocks and thereby reduce RFG production by a multiple of what is made for California market. With the exception of western Canada and the Caribbean the trip time required to deliver from most foreign sources to California would be longer than from the USGC. The time required to resolve supply problems would increase. The term and magnitude of a “Price Spike” would probably also increase. Foreign supply of gasoline to California is more limited by supply quality than it is by foreign flagged vessel availability.

Impact of MTBE Phase-out On Vessel Availability

Only 4 vessels are shown to be MTBE/ethanol “only” capable. Following the phaseout of MTBE, these vessels will not be allowed to transport gasoline or blending components but will be available for ethanol. Therefore, no additional ships will be available for clean products due to MTBE phase-out.

Product Tanker Economics

An important factor in addition to the cost of shipping product is the voyage time. Table 3 summarizes selected voyage times from alternate supply sources to Los Angeles.

Table 3: Alternate Supply Voyage Times to Los Angeles (Days)

USGC	18 + Canal*
Rotterdam	23 + Canal*
Sicily	25 + Canal*
Singapore	23
Persian Gulf	35

*Canal waiting time as of February 2002 was minimal. However, possible waiting time of 4 to 8 days has routinely occurred in the past.

Assembling a foreign cargo may take more time. It will probably take 1 to 7 days to recognize the need to arrange for a cargo once a major unplanned refinery outage has occurred in California. It may take another 1 to 7 days to find the product and another 1 to 14 days to accumulate the product and wait for a ship to be available at the shipping point. The total process can take 2 to 28 days. On average add about 15 days to voyage times and allow alternate supplies to take 35 to 50 days to arrive. This “time and distance” factor is the primary reason that price spikes in California usually last between 4 and 8 weeks before additional cargoes of gasoline begin to arrive.

Alternative to Jones Act Tankers

Blue Water Barges are a potential alternate solution to supply transportation. Blue Water Barges typically transport 150,000 bbls of product at a slow 10-12 knots per hour speed. Typically, ships move 275,000 bbls at 14-15 knots per hour. The California ship movements would arrive much quicker and cost less than a Blue Water Barge. For example, a Blue Water Barge would take approximately 54 days transit time at a rate of \$18,000 per day costing about \$6.50 per barrel. In comparison, a Jones Act product tanker would

cost about \$5.60 per barrel and be advantageous from a marketing standpoint because it takes less time to travel to the West Coast than a barge.

The construction of new larger blue water barges may alleviate some of California's supply problems in the future. These barges are capable of speeds of approximately 13 knots/hour. These larger barges are capable of moving 250,000-275,000 bbls on a single voyage. The construction cost of a new 250,000 bbl blue water barge is significantly lower than a new ship. These new barges may move directly to California or replace ships currently moving products to PADD 1. However, very few of these barges are currently under construction.

Current shipping rates make it difficult to replace these aging tankers. Independent owners control a large number of product carriers. The major oil companies / refiners fear liability problems with tankers and do not typically charter product vessels for the economic life of the tanker. This causes most of the product tankers to be on spot or short-term contracts. The lack of regular long-term contracts makes financing new ships difficult for independent owners.

New Ship Economics

Economics do not justify building ships at this time. New ship economics require lease rates of \$40-\$45,000 per day in order to justify building a new ship. Current rates of approximately \$35,000 per day (as of August 2001) are well below the required rate to make a profitable investment. Many ship builders are reluctant to build ships on speculation that the rates in the future will be higher. Also ship builders are reluctant to build due to the possibility of a Gulf Coast to West Coast Pipeline or a Gulf Coast to Florida Pipeline. The construction of a pipeline to Florida or the West Coast would also idle existing ships and lower freight rates. With a lead-time of about 3 years, investors simply are not willing to take the risk.

Other Issues

California Marine Import Facilities

A more detailed analysis of California receiving facilities and terminal bottlenecks has been assigned to another task. However, it should be noted that California has some significant challenges related to terminal bottlenecks. There are limited facilities that can handle water borne products. California refiners own most of the existing facilities. This has left only a very small number of independent storage facilities in California. There are only a few players available to move product into the California market. In contrast, the East Coast, especially the New York market, has a tremendous number of suppliers available. The low number of independent off loading facilities makes non-California sources extremely reluctant to speculate on their ability to discharge their cargoes.

Stricter Marine Vessel Standards

Many California refiners have adopted very strict certification rules involving clearances for ships calling on California ports. For example, some California refiners will not allow ships older than 25 years to discharge cargoes at their marine import facilities. This eliminates the older US Flagships to bring products to California and thus makes it more difficult for non-California suppliers to risk bringing product to California.

Jones Act Waiver Jones Act Waiver

Historically, it has been believed that a Jones Act waiver would only occur in extreme circumstances. A Jones Act waiver is not likely except during an extremely short-term crisis. It is highly unlikely that this waiver would be allowed for an extended term. While many have forgotten the original reason for the Jones Act, the Jones Act has significant support among a number of diverse groups in the United States. These groups include:

- The trade unions that build and operate the ships.
- Ship builders who claim higher US wages and environmental standards make them non-competitive.
- Current U.S. flagship owners who would have a competitive disadvantage if their high cost ships were forced to compete with foreign flagged ships.
- Railroads and pipeline operators whose margins are protected by the higher Jones Act shipping costs.
- Environmentalists who believe double-hulled vessels that replace single hulled vessels are better than foreign ships.
- Refiners, especially California refiners, whose margins are insulated and thus can bear the higher cost of using Jones Act vessels to move product in from other states.

While the support from each of these diverse groups ranges from simply not requesting a waiver to strongly opposing a waiver, the combined result is that a waiver is unlikely to occur and if it did it will be short lived.

Conclusions

In the near term, it will be difficult if not impossible to find enough US flagged vessels to satisfy the potential California supply shortfall caused by the removal of MTBE from California gasoline. In the longer-term, in post 2005 time-frame, OPA90 retirements will create a significant tanker shortage. Vessels between USGC and the Lower Atlantic states must be replaced either by new vessels or a pipeline. Current tanker rates do not justify new construction and the fear of a pipeline inhibits tanker investments. This leads to the conclusion that California must rely on foreign supply for at least a portion of the shortfall that will occur following the removal of MTBE from the CARB gasoline.